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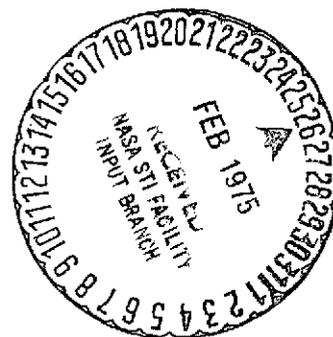


SKYLAB MEDICAL DATA CENTER AND ARCHIVES

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16. Abstract The founding of the Skylab Medical Data Center and Archives by the Life Sciences Directorate as a central area to house medical data from space flights is described. Skylab Program strip charts, various daily reports and summaries, experiment reports and logs, status reports on Skylab data quality, raw data digital tapes, processed data microfilm, and other Skylab documents are housed in the data center. In addition, this memorandum describes how the data center acted as a central point for the coordination of preflight and postflight baseline data and how it served as the Life Sciences Directorate coordinator for all data processing through the Computation and Analysis Division. Also described is a catalog identifying Skylab medical experiments and all related data currently archived in the data center.			
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Fred R. Spross
Lyndon B. Johnson Space Center
Houston, Texas 77058

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By Fred R. Spross
Lyndon B. Johnson Space Center

SUMMARY

The Skylab Medical Data Center and Archives at the NASA Lyndon B. Johnson Space Center was founded by the Life Sciences Directorate to house medical data from Skylab space flights. The center houses such selected Skylab documents as strip charts, daily reports and summaries, experiment reports and logs, status reports on data quality, raw data digital tapes, and processed data microfilm. The Medical Data Center and Archives also served as a central point for the coordination of preflight and postflight baseline data. In addition, the center acted as coordinator for the Medical Experiments Hardware project engineers and the Test Division Instrumentation Integration Branch and as Life Sciences Directorate coordinator for all data processing through the Computation and Analysis Division. Based on the successful operation of the Medical Data Center and Archives during each Skylab mission and the massive amount of data accumulated, a catalog was completed identifying and describing Skylab medical experiments and all related data presently archived in the data center. Currently, plans are being considered to expand the center to include researching and obtaining medical data from past space-flight programs and setting up operations for all future programs.

INTRODUCTION

Before the Skylab Program, medical data from space-flight programs were stored at locations throughout the NASA Lyndon B. Johnson Space Center (JSC). Much of the data was in the personal files of researchers and not readily accessible to other interested individuals within or outside NASA. Additionally, because of the massive quantity of medical data that was expected to be generated during the Skylab missions, a central area was needed to ensure that these data were properly collected, processed, verified, cataloged, distributed, and archived in a timely manner to support the Skylab Program and also to provide a central working area for medical research based on these data. Thus, the Skylab Medical Data Center and Archives was established.

Currently, the data center contains the Skylab Medical Experiment Altitude Test and Skylab-related medical data including medical experiment and operational systems hardware data. Later, the center may be expanded to include medical data from previous and future programs. The overall intent is to establish a central area where NASA personnel, contractors, or independent research

representatives can retrieve and study space-flight-related medical data and where valuable research data can be stored to avoid their loss through personnel changes.

As an aid to the reader, where necessary the original units of measure have been converted to the equivalent value in the Système International d'Unités (SI). The SI units are written first, and the original units are written parenthetically thereafter.

GENERAL DESCRIPTION

During the Skylab Program, the Skylab Medical Data Center and Archives was located in building 36 and consisted of two rooms totaling 139 square meters (1500 square feet).

The primary room served as a central point and work area for receiving, processing, and distributing all experiment- and mission-related data. This area contained support contractor personnel desks, work tables, drafting tables, and numerous filing and storage cabinets. Data contained in this room consisted of strip charts, all the various daily reports and summaries, experiment reports and logs (which were used extensively to maintain data flow), and status reports on data quality during each phase of the Skylab mission.

The second room was used to store raw data digital tapes, processed data microfilm, and selected Skylab documents. Also, a working area was set up within this room for visiting Principal Investigators. It contained a desk, work table, strip-chart scanner, microfilm reader/printer, and a programable desk calculator.

Operation of the data center was supervised by the NASA Life Sciences Directorate (LSD) medical data manager, supported by five contractor personnel. These included an assistant data manager, responsible for carrying out tasks assigned by the NASA data manager; a data clerk/typist, responsible for logging data, maintaining status charts, and doing general typing and data filing; two graphics data plotters, responsible for maintaining crew-health-trend charts and other selected graphic presentation material; and a data messenger, responsible for the pickup, delivery, and distribution of all raw and processed data and reports.

The data center was staffed on a one-shift operation, 5 days a week, unless otherwise required for special projects or unusual data processing. Another JSC contractor also supported the data center by establishing, reviewing, and processing new medical requirements from the Principal Investigators and by assisting in troubleshooting data-processing problems.

DISCUSSION

The operation of the data center was initiated with the development of the following documents.

1. Skylab Medical Data and Calibration Management Plan, April 1973
2. Skylab Medical Requirements, April 1973
3. Skylab Medical Operations Reporting Plan, March 1973
4. Data Management Handling Standard Operating Procedures, June 1973

The Skylab Medical Operations Reporting Plan served as a major guide and driving force because it outlined the data types to be generated, the general data flow, and the organization or individual responsible for each data item. The plan identified the methods and forms to be used by all groups reporting on all data aspects from quick-look data transmittals to final data-evaluation reports.

After the completion of the Skylab mission, all medically related data contained within the data center were summarized in the Skylab Medical Data Center and Archives catalog, including a brief description of all documentation, data, and reports.

OPERATIONS

The data center acted as a central point for the coordination of preflight and postflight baseline data sessions. As such, the data center maintained close contact with the Crew Training Office, the Principal Investigators and their representative, the Medical Data System experiment raw-data-recording personnel, the Skylab Mobile Laboratory experiment raw-data-recording personnel, and the Computation and Analysis Division (CAD) data-processing personnel. This liaison ensured that acceptable baseline data were scheduled, generated, recorded, processed according to the established requirements, distributed to the appropriate investigators, and archived for future research. Also, selected end-products or verified data were returned from the Principal Investigators for use in maintaining timeliness of data and for gross indications of each crewman's health for LSD and NASA Headquarters management.

The data center served as the LSD coordinator for all data processing through the CAD. Coordination included the physical delivery, pickup, and distribution of data products, maintenance of data-processing status, verification of acceptance by the Principal Investigators, and management of any necessary reprocessing software changes or modifications based on final output data analysis by the Principal Investigators.

Major off-line software changes were submitted to the CAD through the use of a formal Software Change Request. The Software Change Request was approved for submittal to the CAD through either a division- or a directorate-level signature, depending on the extent of the change and the potential effect on programming and processing schedules. Minor changes with little or no schedule impact were handled at the branch level.

As part of the data-processing function, the data center also served as coordinator between the Medical Experiments Hardware project engineers and the Test Division Instrumentation Integration Branch to ensure that all hardware calibrations were processed and current. These calibrations included each piece of individual equipment in the one-g trainer, in the Skylab Mobile Laboratory, and in the Skylab orbital workshop. These calibrations were necessary for proper data processing by the CAD.

Final data verification was performed by each respective Principal Investigator or his representative and reported to the data center through the use of the Experiments Data Collection Report (fig. 1). If the data were not accepted, this report briefly outlined the necessary corrective action.

Selected medical parameters from each experiment run were verified by the Principal Investigators and reported on the Experiments Data Summary Report (fig. 2). These parameters were summarized, transmitted to the crew surgeon by the data center, and plotted on crew-health-trend charts for use by the Medical Management Team.

The data center served as a central coordinator for all data flow during the preflight and postflight phases of each mission. A typical data flow is illustrated in figure 3. Duplicate copies of all data distributed were maintained in the Skylab Medical Data Center and Archives for future use. Current charts and logs were maintained throughout each phase of the data flow to allow visibility of the overall transfer and distribution of data.

The data center maintained close liaison with the Mission Control Center medical staff support room, the mission surgeon, and the Medical Management Team during the flight phase of each mission. The staff support room served as the central point of contact during the flight portion of the mission; however, the data center maintained an active role in keeping the data flow current, in distributing data outputs, in ensuring proper data verification or validation by the Principal Investigators or principal coordinating scientists, and in implementing any necessary processing corrections. In addition, this effort included maintaining the crew surgeon's medical data log, which contained a daily chronological tabulation of selected medical parameters from each experiment; reviewing all data-processing status with the medical staff support room and the Principal Investigators to ensure rapid distribution and validation of the data; and supporting the Medical Management Team through the daily maintenance and updating of crew-health-trend charts (fig. 4).

The crew-health-trend charts consisted of individual graphic plots of selected medical parameters (for each experiment and for each crewman) for quick identification of any significant changes from a preflight range. Two sets of 18 trend charts were used during the mission. One set was on permanent display in the Mission Control Center medical team conference room, and the duplicate set was used as a master copy for weekly photographic reproduction. During the second and third manned missions, nine additional color charts were maintained; these charts combined data for all crewmen and all missions to show a direct and immediate comparison between individuals and missions. These charts were also photographically reproduced each week.

Specifically for LSD management use, the data center coordinated special graphic computer data processing of each individual hardware experiment run. Copies of the trend charts and of the special computer processing were routinely delivered to the LSD office and mailed to NASA Headquarters every week throughout the preflight, inflight, and postflight phases of all missions.

These crew-health-trend charts and the computer-processed graphics data served as very useful tools not only for delineating crew performance during a test but also for depicting scheduling and data-flow problems and status.

Based on the successful operation of the Medical Data Center and Archives during each Skylab mission and the massive amount of data accumulated, a catalog was completed at the end of the Skylab Program. The catalog identifies and describes the Skylab medical experiments and all related data presently archived in the data center. The catalog includes, but is not limited to, all related documentation of the mission, requirements, hardware specifications, and operational procedures; it also outlines the procedure for researchers to request data for use and study.

Because the potential for this centralized medical data research area is so great, plans for expansion are being considered. Areas for expansion include researching and obtaining medical data from past space-flight programs as well as planning for continued active operation during all future programs.

CONCLUDING REMARKS

The Skylab Medical Data Center and Archives was established before the Skylab Program to provide a central repository for space-flight medical data. Data contained in the center include strip charts, all the various daily reports and summaries, experiment reports and logs on data flow, and status reports on data quality for each phase of the Skylab Program. In addition, raw data digital tapes, processed data microfilm, and other selected Skylab documents are housed in the data center. The data center acted as a central point for the coordination of preflight and postflight baseline data. During the Skylab Program, the data center also served as the Life Sciences Directorate coordinator for all data processing through the Computation and Analysis Division. The center also coordinated the Medical Experiments Hardware project engineers

and the Test Division Instrumentation Integration Branch. Based on the successful operation of the data center during each Skylab mission and the massive amount of data accumulated, a catalog was completed to identify and describe Skylab medical experiments and all related data presently archived in the data center. Plans are being considered to expand the data center to include researching and obtaining medical data from past space-flight programs and setting up operation for all future programs.

Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas, December 20, 1974
948-90-90-89-72

1. Experiment ID: M092 ___; M093 ___; M131 ___; M171 ___; Other _____			
2. Mission: SL-2 ___; SL-3 ___; SL-4 ___; Other _____			
3. Phase: Preflight ___; Inflight ___; Postflight _____			
4. Subject ID: 1 CDR ___; 2 SPT ___; 3 PLT ___ (Prime Crew)			
4 CDR ___; 5 SPT ___; 6 PLT ___ (Backup Crew)			
Other _____			
5. Date of Experiment: _____ Run No. _____			
6. Experiment data acceptable: Yes ___ No ___			
If no, complete Items 7, 8, 9, and 10 listed below.			
7. Equipment or measurement anomalies: _____			

8. Procedural anomalies: _____			

9. Data processing anomalies: _____			

10. Recommended corrective action to Items 7, 8, and 9: _____			

Reference No.	Signature, PCS	Date	Signature, Mission Manager

E X A M P L E

Figure 1.- Experiments Data Collection Report.

SL- _____

Subject ID _____

PI/PCS Signature, Date _____

CDR SPT PLT _____

M092

Subject Name: _____ Test Start Time: _____ Test Julian Day _____
Report Time (MSC Local) _____

OPERATIONAL VERIFIED DATA SUMMARY		
Test (Control Phase)		
Mean Heart Rate	_____	BPM
Mean Syst/Diast BP	_____	mmHg
Max. LBNP ΔP (-50 mmHg- Period 4)		
Mean Heart Rate	_____	BPM
Mean Syst/Diast BP	_____	mmHg
Recovery Phase (Period 5)		
Mean Heart Rate	_____	BPM
Mean Syst/Diast BP	_____	mmHg
Waveform Data (ECG) (Event of Arrhythmia During Test)		
<div style="border: 2px solid black; transform: rotate(-45deg); display: inline-block; padding: 10px 20px; font-weight: bold; font-size: 1.2em;">EXAMPLE</div>		
Uplink Medical Data Log		
Max. LBNP ΔP (-50 mmHg- Period 4)	_____	%
Mean ΔLeg Volume	_____	%
Resting Left Leg Calf Circ.	_____	Inches
Comment		
Reference No.	Signature, Mission Manager	Date

Figure 2.- Experiments Data Summary Report.

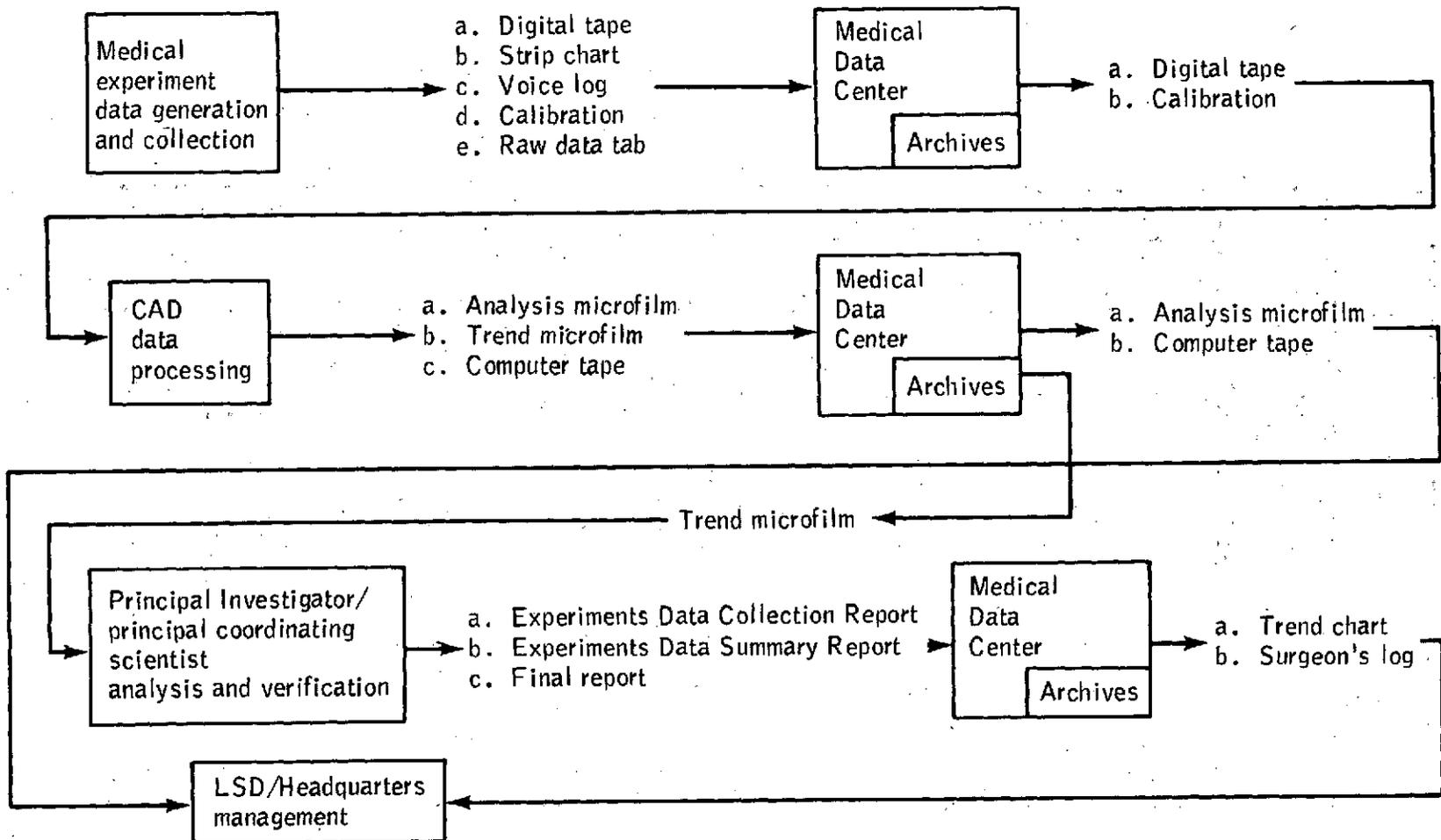


Figure 3.- Typical data flow during each Skylab mission.

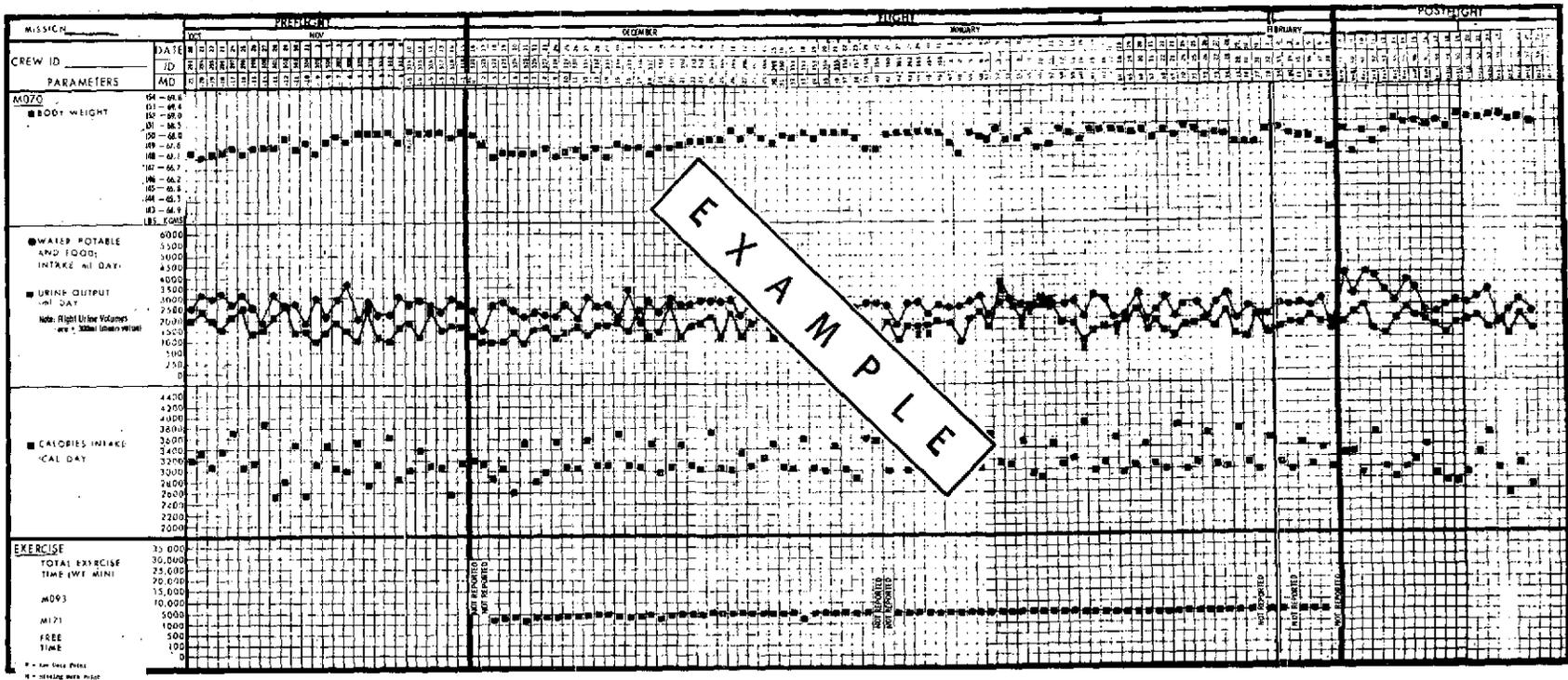


Figure 4.- Skylab crew-health-trend chart.